

STIPA LEMMONII (VASEY) SCRIBNER (POACEAE): A TAXONOMIC AND DISTRIBUTIONAL STUDY

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ABSTRACT

Stipa lemmonii (Vasey) Scribner is sometimes treated as comprising three varieties: var. *lemmonii*, var. *jonesii*, and var. *pubescens*. Morphological and distributional data obtained from over 300 specimens representing the geographic range of the species do not support recognition of these infraspecific taxa. The known range of the species is extended to include Nevada and Utah.

Stipa lemmonii (Vasey) Scribner is a native grass of western North America. Two varieties have been described: *S. lemmonii* var. *jonesii* Scribner and *S. lemmonii* var. *pubescens* Crampton. These, together with var. *lemmonii*, are the subject of this study. Scribner (1901) described var. *jonesii* as "a small form of the species with rather more slender culms and panicles, and spikelets with the outer glumes 7–8 mm long and flowering glumes about 6 mm long." He cited five specimens but did not suggest any geographic or ecologic peculiarities for the variety. *Stipa lemmonii* var. *pubescens* was described (Crampton 1955) as being similar to the species, differing in "having the blades and sheaths entirely pubescent." Crampton cited two specimens, one of which (the holotype) had been growing in serpentine soil.

Taxonomists have varied in their treatment of these two varieties. Abrams (1923), Hitchcock (1925, 1935, 1951) and Munz (1959) accepted var. *jonesii*, but Peck (1961) and Hitchcock et al. (1969) did not. Munz (1959) also recognized var. *pubescens*, the only one of these authors to do so. In this work, the validity of these two varieties is analyzed by examination of a large number of herbarium specimens representing the full morphologic and geographic range of the species.

MATERIALS AND METHODS

More than 300 herbarium specimens from several herbaria (see acknowledgments) were examined. Of these, 199 were selected for use in the numerical analyses. These included all specimens with pubescent sheaths and up to five additional specimens per county.

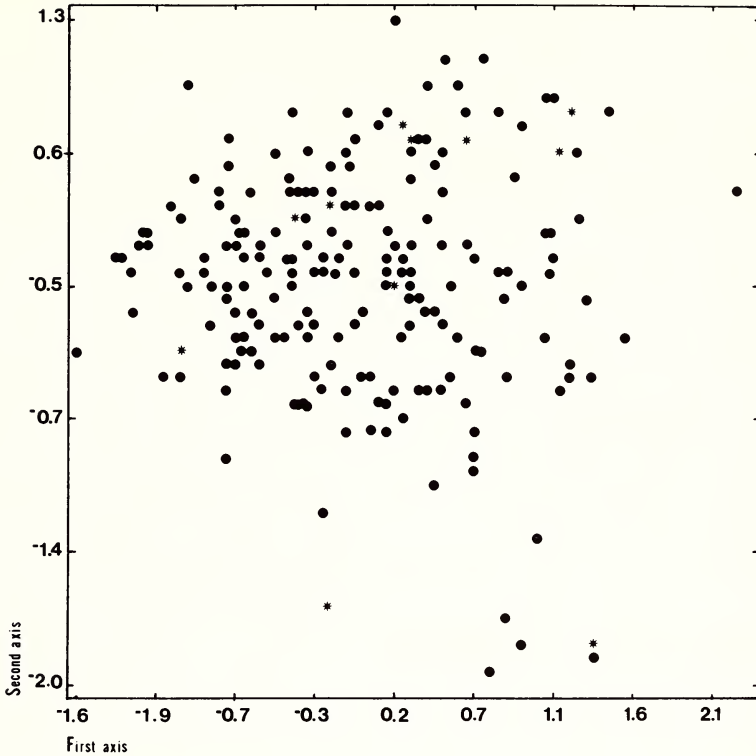


FIG. 1. Projection of the OTUs onto the first two principal axes. The first axis accounts for 50% of the variance, the second for 30%. The weights associated with each character on the two axes are (character first axis, second axis): Culm 0.663, -0.577; inflorescence 0.686, -0.560; glume 0.775, 0.465; floret 0.710, 0.571. Stars = pubescent specimens; dots = glabrous specimens.

These specimens all came from the U.S. Information on the morphological variation and distribution of the species in Canada was obtained from a previous study (Barkworth, unpubl. ms.).

Five morphological characters, reputed to distinguish the varieties, were scored on each of the specimens used in the numerical analyses: culm length, inflorescence length, lower glume length, lemma length (including the callus) and presence or absence of pubescence on the lower leaf sheaths. The geographic and ecological data on the label were also recorded. Soil type was scored as serpentine, non-serpentine, or, unless specifically stated otherwise, unknown.

To determine whether the species could be divided into distinct groups of small ("var. *jonesii*") and large ("var. *lemmonii*") plants, principal component analysis (PCOMP) was run on the four quan-

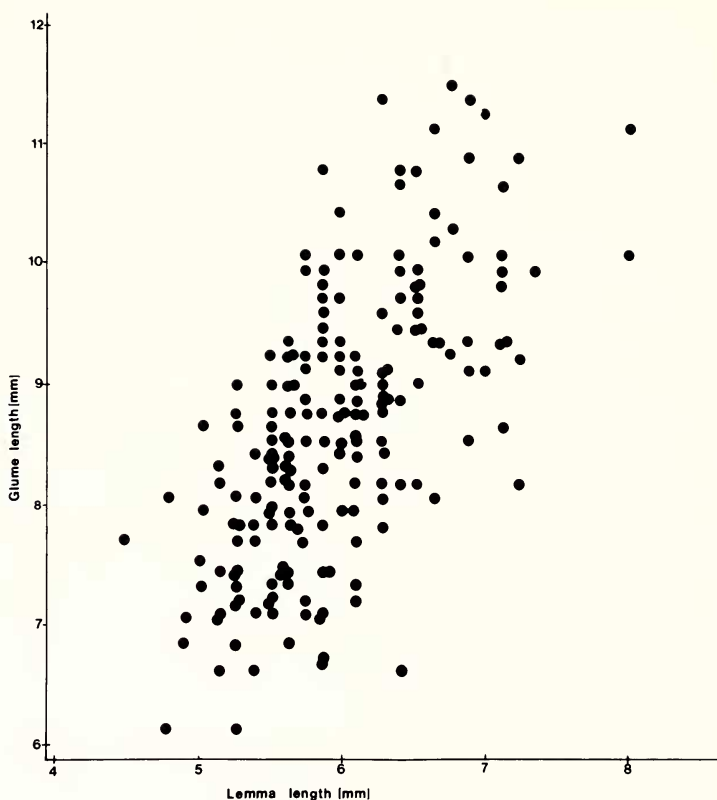


FIG. 2. Scattergram of glume length versus lemma length. The regression equation is: $\text{glume length} = 1.525 + 1.194 (\text{lemma length})$.

titative characters. In addition, glume length was plotted against lemma length because these two characters were specifically cited by Scribner in his description of var. *jonesii*.

To investigate the status of var. *pubescens*, we examined the degree of association between pubescence and serpentine soils. The chi-

TABLE 1. SUMMARY OF THE MORPHOLOGICAL DATA FOR *Stipa lemmonii* (n = 199).

Character	Minimum	Maximum	Mean	SD
Culm length (cm)	15.8	89.5	44.3	14.1
Inflorescence length (cm)	7.7	21.0	10.2	2.6
Lower glume length (mm)	6.1	11.5	8.6	1.1
Floret length (mm)	4.5	8.0	6.0	0.6

square statistic, as modified by Yates for use with 2×2 tables (Steel and Torrie 1960, Nie et al. 1975) was used to assess the statistical significance of the association between pubescence and serpentine soil. The programs used were NTSYS (Rolf et al. 1976) and SPSS (Nie et al. 1975). They were run on a VAX 11/780.

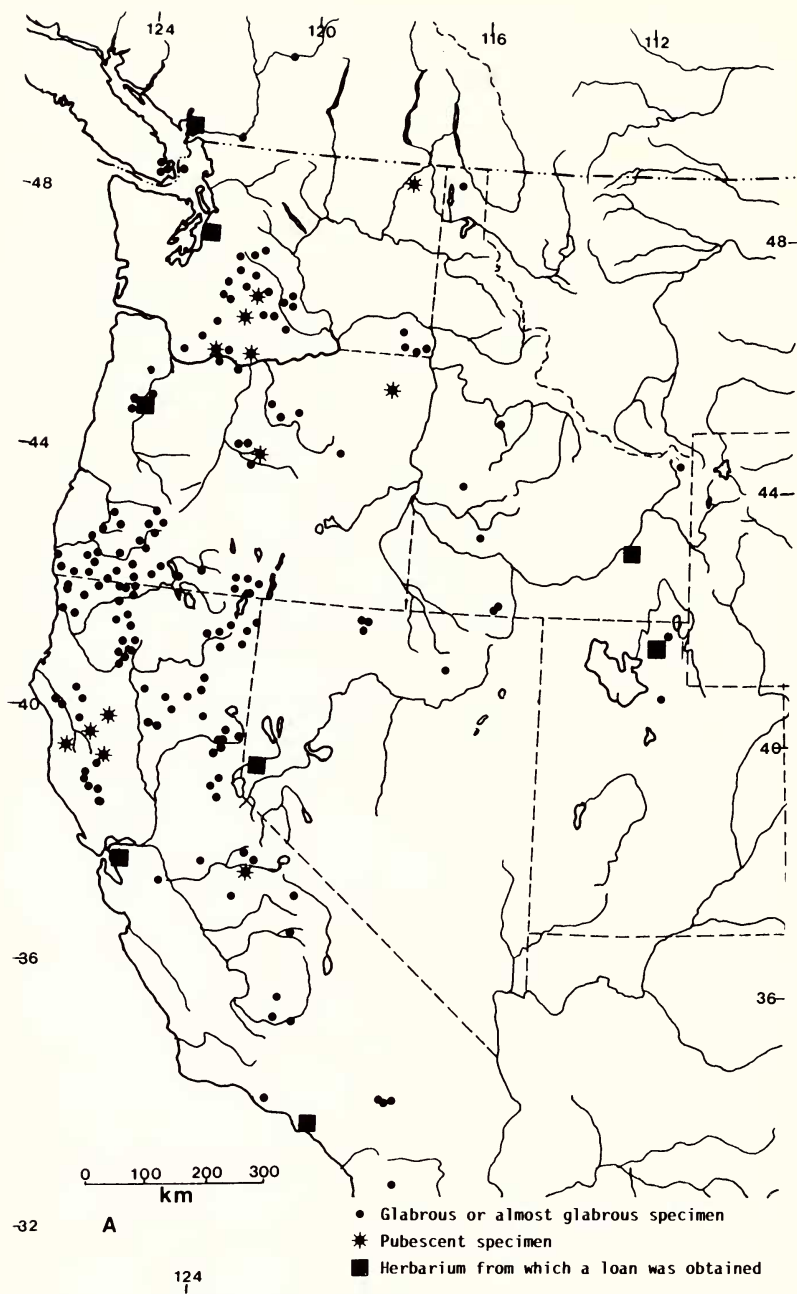
RESULTS

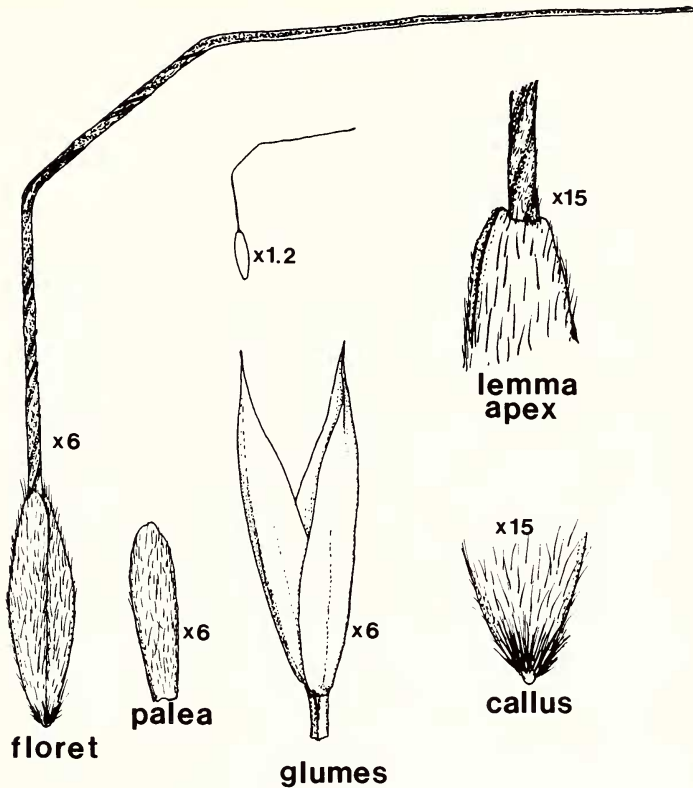
The PCOMP analysis (Fig. 1) provides no support for the recognition of any infraspecific taxa. Glume and floret length contribute most to the first axis (weights of 0.775 and 0.710 respectively) but the others were also positive (culm length 0.663; inflorescence length 0.686). On the second axis, culm and inflorescence length had negative coefficients (-0.577 and -0.560 respectively) although glume and floret length had positive coefficients (0.465 and 0.571 respectively). The distribution of the OTUs on the first two axes of the PCOMP plot (which account for 80% of the total variance) appears to be random. The same is true of the third axis. Similarly, the scattergram of glume length versus culm length (Fig. 2) does not suggest any easy division of the OTUs into "small" and "large" specimens. Thus our data provide no support for the recognition of *S. lemmonii* var. *jonesii* as a distinct taxon. Table 1 presents a synopsis of the quantitative data.

Positive information on soil type was available for only 42 specimens. Of these, 39 were among those used in the rest of the study. We added three "specimens" to represent the pubescent specimens collected on serpentine soils by Dibble and Griggs (1979). Only five of the 42 specimens were pubescent. Four (including the Dibble and Griggs specimens) were from serpentine soil, the other from sandy soil. There were 18 other specimens from serpentine soil, but all these had glabrous leaf sheaths. The corrected value of chi-square was 0.70; thus the association between pubescence and serpentine soils is not statistically significant.

On seven pubescent specimens the soil type was not specifically stated but the habitat descriptions on the labels do not suggest serpentine soils (e.g., blue oak woodland; open sagebrush slope; grassy slope with ponderosa pine; open woods). Pubescent plants do not appear to be geographically limited in their distribution: collections have been made at scattered locations in Washington, Oregon, and California (Fig. 3). Since no other morphological or ecological characteristic appears to be associated with the presence of pubescence on the leaf sheaths we suggest that var. *pubescens* does not merit formal recognition.

This taxonomic decision is of interest to more than the botanical community because *Stipa lemmonii* var. *pubescens* has been nominated for endangered plant status (U.S. Fish and Wildlife Service

FIG. 3. Distribution of *Stipa lemmonii*.

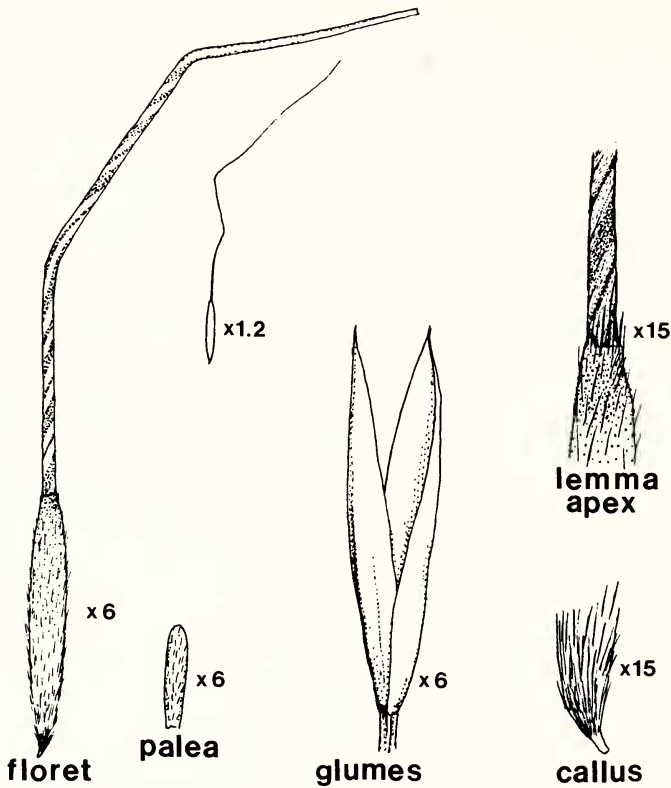


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FIG. 4. Spikelet of *Stipa lemmonii*.

1976). Dibble and Griggs (1979) state that it is associated with serpentine chaparral communities. Moreover, they state that their field observations suggest that the most pubescent plants grow on red, decomposed serpentine; less pubescent plants, on green, undecomposed serpentine; and glabrous plants, on the surrounding, non-serpentine soil. Their observations were, however, limited to three serpentine locations in Lake and Tehama Counties, California. Further observations are needed at other sites.

We suggest that the presence or absence of copious pubescence may be determined by a very small number of genes, possibly only one or two, for which the character state "copiously pubescent" represents the recessive allele. If this is true, pubescent plants can be expected to occur, albeit at low frequency, wherever the necessary



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FIG. 5. Spikelet of *Stipa nelsonii*.

alleles are present. At some locations the genes for pubescence may be linked to those for serpentine tolerance. This would account for the tolerance gradient observed by Dibble and Griggs. Variation in the degree of pubescence between duplicate herbarium specimens (e.g., *Opeck 1055*, *Rogers 422*, *Hitchcock and Muhlick 22382*) indicate that the degree of pubescence is variable within a population. Dibble and Griggs also noted that the two forms sometimes grow together. The frequency of pubescent plants should be expected to vary from one locality to another, depending on the genotypes present in the founding members and linkage to other traits.

The distribution map of *S. lemmonii* (Fig. 3) shows some additions to the reported range of the species. Holmgren and Holmgren (1977) described the species as "approaching [the Intermountain

Region] on the west and possibly entering it." The following specimens confirm that it is present in Nevada: HUMBOLDT CO.: *J. L. Gentry, Jr. and G. Davidse 1573*. Santa Rosa Range, T42N R38E S25, 19 Jun 1967; *A. Tiehm and M. Williams 1200*. Santa Rosa Range, Hinkey Summit, 28 Jun 1975. Its presence in Utah is documented by: CACHE CO.: *M. Barkworth, J. Maze and R. J. Shaw 4233*. Jardine Juniper Trail, 12 mi e. of Logan, 19 Jun 1983; *M. Barkworth, J. Maze and R. J. Shaw 4234*. Cottonwood Canyon trail, 14 mi e. of Logan, 19 Jun 1983; *M. Barkworth 4240*. Temple Fork turnoff from Canyon Road, 17 mi e. of Logan, 26 Jun 1983; *M. E. Jones s.n.*, Wasatch Mountains, July 1880. [Dr. S. Welsh (Brigham Young University) informed us that Jones collected in City Creek and American Fork Canyons near Salt Lake City towards the end of that month.]

The Nevadan specimens were misidentified as *S. columbiana* sensu A. S. Hitchcock, i.e., *S. nelsonii* Scribner (Barkworth and Maze 1979, 1982; Barkworth et al. 1979). These two species are frequently confused, but *Stipa lemmonii* (Fig. 4) has a "hump" at the apex of the lemma and a palea that is subequal to the lemma. *Stipa nelsonii* (Fig. 5) often has apical lemma lobes but they are membranous, not thick and humplike, and its palea is only about half the length of the lemma. Jones had identified his specimen as *S. viridula*, a species that differs from *S. lemmonii* in having a very short, glabrous, palea.

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